PORTUGAL

ON THE WIND OF INNOVATION

One of the oldest states in Europe, Portugal is a developed and a high-income country but with the lowest per capita GDP in Western Europe. The economy is mainly based on agriculture, fishing – following its long tradition as a sea fairing power – and mining. A diversified industry is ranging from automotive, aerospace, electronics and textiles, to food, chemicals, cement and wood pulp. Portugal is further an innovative modern country with intensive scientific and technological research activities. Portugal-based innovation is in 15th position in international rankings.

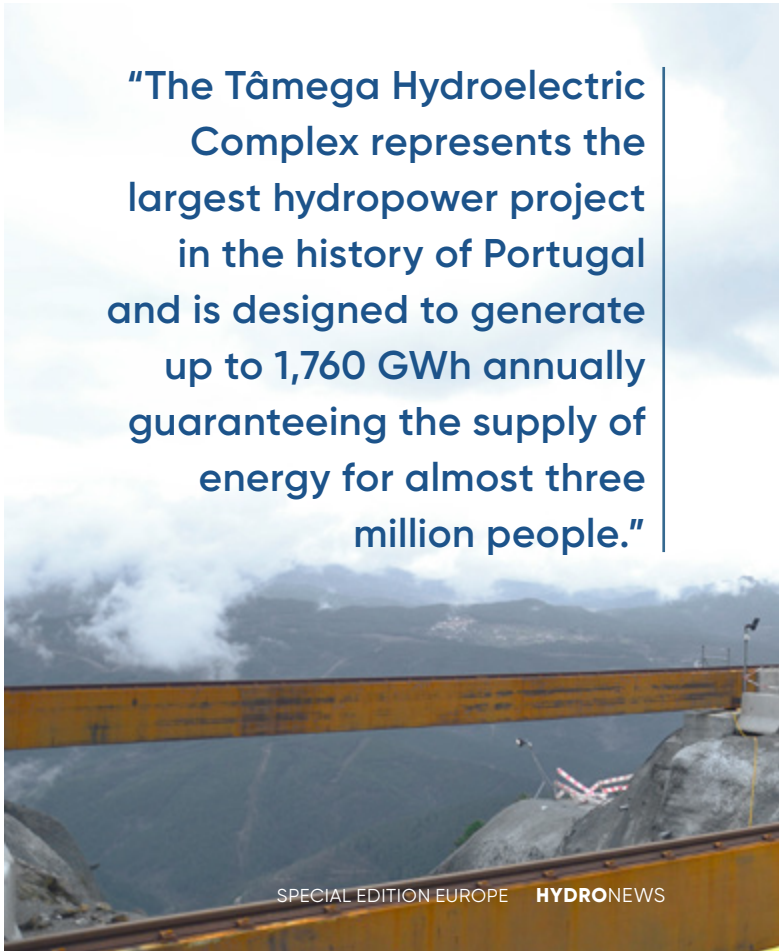
Until recently, the country's primary energy source was hydropower. There is considerable hydropower potential, with most hydropower plants located in the mountainous northern region. About a third of the total installed hydropower capacity of 7,193 MW is pumped storage.

Wind is also emerging as an important energy source. In 2006, the world's largest solar power plant at that time, the Moura photovoltaic Power Station, began operating near Moura in the south of the country. In 2017, renewable energy generation supplied almost 39% of the total generation. The government has implemented measurements to promote renewable energy. To balance variable energy sources like wind and solar, pumped storage power plants will play an increasingly important role. However, the "National Plan for Dams with High Hydroelectric Potential" is currently being reevaluated in the context not only of economic and energy production factors, but also the quality of water flows and water bodies. As a result, the government has placed all planned hydropower construction projects on hold whilst this review takes place.

ANDRITZ HYDRO IN PORTUGAL

ANDRITZ has been delivering hydropower equipment to Portugal since 1914 and has equipped numerous plants. These include the Ermida, Ribeiradio, and Bemposta plants, Bemposta being one of the largest pumped storage hydropower plants in Western Europe. On the occasion of the execution of the works for the pumped storage hydropower plant Baixo Sabor, ANDRITZ Hydro established a local company based in Porto. The objective in establishing this company was not only to cover the work for a specific project, but also to base skilled and

"The Tâmega Hydroelectric Complex represents the largest hydropower project in the history of Portugal and is designed to generate up to 1,760 GWh annually guaranteeing the supply of energy for almost three million people."



experienced personnel in Portugal for global site installations. The Porto company supports ANDRITZ Hydro manufacturing capabilities in locations such as Ravensburg in Germany or Weiz in Austria, for example.

Meanwhile, installation and commissioning teams from Portugal are in action not only in Portugal itself, but also around the world in Austria, Norway, Iceland, Angola, Malawi, Lao, Vietnam, Peru and elsewhere. An impressive list of references shows the efficiency and high quality performance of the installation teams operating out of Porto.

Close corporation with universities and agencies also allows ANDRITZ to offer specialists for site management and supervision with multi-disciplined personnel who can work on multiple products – such as turbines, generators, gate installation, EPS installation and commissioning – as and when this is required.

Source Facts:The World Bank, IHA, CIA Factbook, Hydropower & Dams World Atlas 2018

BAIXO SABOR, SABOR RIVER

ANDRITZ supplied the electro-mechanical equipment for two powerhouses (Montante and Jusante) for the Baixo Sabor complex. The scope of supply included two reversible pump turbines with auxiliary systems, generators, power bus bars, transformers, switchgear, the complete automation and control system, and auxiliary equipment for the turbine house. Particular challenges associated with this project included the extremely wide operational spectrum in regard to the water head and load at the Montante powerhouse, as well as the use of reversible pump turbines for the unusually low water heads found at Jusante. The Baixo Sabor hydropower complex began operations in 2016.

Bemposta Dam, Douro River

On site installation work Gouvães, Tâmega River

GOUVAES, TÂMEGA RIVER

In 2017, ANDRITZ received a contract to supply the electro-mechanical equipment and the penstock for the new Gouvães pumped storage power plant, the heart of the Alto Tâmega hydropower scheme. The scope of supply comprises design, manufacturing, delivery, and installation supervision for the reversible pump turbines, motor generators, and electrical power systems. Also part of the contract are design, manufacturing, supply, and complete installation of a penstock, including three bifurcators with a total weight of about 12,000 tons, an average diameter of about 5,400 mm and a length of 2.5 km.

TO KNOW

GENERAL FACTS

Population: **10,3 Mio.**
Access to electricity: **100%**
Installed hydro capacity: **7,193 MW**
Hydro capacity under contruction: **1,158 MW**
Share of generation from hydropower: **10%**
Hydro generation per year: **5,536 GWh**
Technically feasible hydro generation potential: **24,500 GWh**

ANDRITZ HYDRO IN THE COUNTRY

Installed and/or rehabilitated capacity: **5,619 MW**
Installed and/or rehabilitated units: **231**
Locations: **Porto**

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